NOAA National Severe Storms Laboratory

CI-FLOW

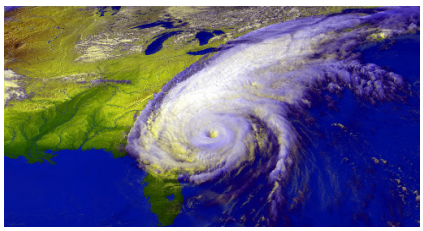
Coastal and Inland Flooding Observation and Warning

What is CI-FLOW?

Coastal and Inland FLooding Observation and Warning (CI-FLOW) is a multi-agency research project to provide total water level forecasts in coastal areas. Tides, extreme waves, storm surge, and rainfall from hurricanes, tropical storms and other hazardous weather push tremendous amounts of water into coastal watersheds. Routine water level simulations that capture the complex interaction between waves, tides, river flows and storm surge have not been possible until now. CI-FLOW's prototype system combines observations, weather and water models, and decision support tools to better forecast and prepare for inland and coastal floods.

Vulnerable coasts

Coastal areas are home to a wealth of natural and economic resources and are among the most developed areas in the nation. The narrow fringe that makes up 17 percent of the contiguous U.S. land area is home to more than half of the nation's population. CI-FLOW is motivated by the absence of accurate, high-resolution routine water level information at key points in these areas. CI-FLOW will make great strides towards increasing warning times and improving predictions to save lives and limit property damage.



Hurricane Floyd as it hits North Carolina.

Hurricane tragedies drive CI-FLOW partners

Hurricanes Dennis and Floyd devastated coastal North Carolina in 1999 with storm surge and coastal flooding that killed 52 people and destroyed 7,000 homes. The area received 20-25 inches of rain over 10 days, causing rivers to crest up to 24 feet above flood stage. The storm surge was measured as high as 13 feet. Additional widespread impacts on the region included livestock and pet evacuations, water pollution from farm animal waste management sites, and backwater flooding due to inadequate bridge design.

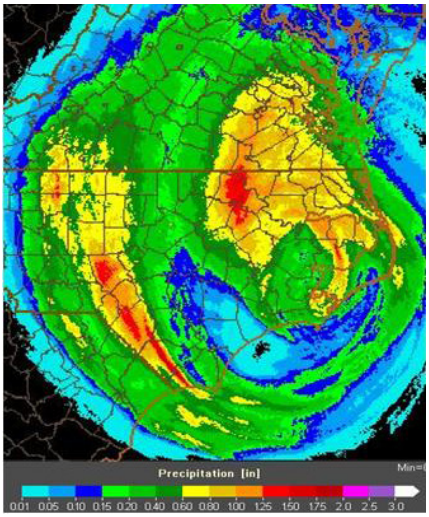
In response, a diverse group of people, including local, state, regional, academic and federal partners, and emergency management communities formed CI-FLOW with a united goal to improve flood predictions and warnings. As a starting point, CI-FLOW focuses on the Tar-Pamlico and Neuse river basins of coastal Carolina, the areas hit hardest by the effects of the 1999 hurricanes.

A flexible system

The CI-FLOW system interactively exchanges data between atmospheric, river, and ocean models to produce simulations of total water level, taking into account tides, surge, waves, and river flow. It is also technically capable of producing simulations for a given location in any coastal watershed. Data from emerging technologies, including dual-polarized radar and multi-sensor systems will be brought into CI-FLOW to demonstrate and evaluate hydrologic forecasting at higher time and space resolutions than previously possible. This ability to provide total water level quantity information from the headwaters of a coastal watershed to the shoreline truly connects the summit to the sea.

From the sky

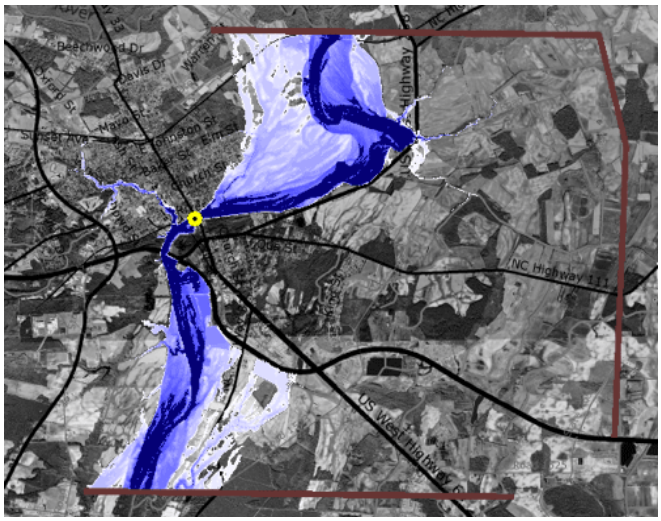
Leveraging NSSL research systems, CI-FLOW tracks raindrops as they fall from the sky to the summit using radar, rain gauge, and satellite information from across the nation. Rainfall data is then processed by NSSL computing systems to create five-minute estimates of rainfall. This capability allows forecasters to keep a constant watch of precipitation falling onto U.S. watersheds.



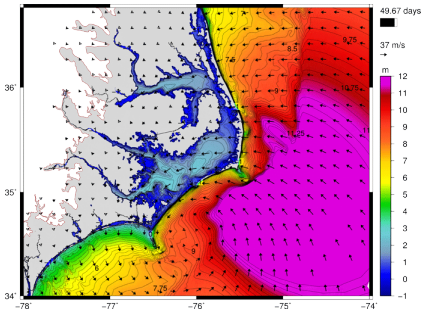
CI-FLOW uses multi-sensor precipitation estimates from the NSSL Q2 system to track rainfall amounts within the Tar-Pamlico and Neuse river basins every 5 minutes on a 1km scale.

To the summit

Water quantity models simulate freshwater flows in the rivers, taking into account soil type, slope of the land, and vegetation patterns. These simulations will help forecasters know where flooding may occur.



The CI-FLOW streamflow simulation for the Tar River in Tarboro, North Carolina is linked to the respective National Weather Service inundation map to show the expected extent and depth of water.



Forecast significant wave heights from Hurricane Isabel.

To the sea

Ocean models provide simulations of waves, tides, and storm surge. To account for the water in tidal plain, the CI-FLOW system passes flow data from water quantity models to ocean models. This approach insures flood flows are accounted for in total water level prediction. When a storm approaches, forecasters will have a better idea how the ocean and river water will interact and impact the coast.

CI-FLOW partners

Partners include NOAA's National Severe Storms Laboratory, North Carolina Sea Grant, South Carolina Sea Grant, Texas Sea Grant, National Sea Grant, University of Oklahoma, University of North Carolina at Chapel Hill, National Weather Service Raleigh Forecast Office, National Weather Service Newport/Morehead City Forecast Office, National Weather Service Southeast River Forecast Center, NOAA's Coastal Services Center, NOAA in the Carolinas, Centers for Ocean Sciences Education Excellence SouthEast, National Weather Service Office of Hydrologic Development, and National Ocean Service Coast Survey Development Laboratory.

Benefits of CI-FLOW

- More accurate flood and flash flood forecasts based on linked weather and water data
- Routine predictions of total water level and its individual components for the coastal plain
- More precise water information for coastal emergency managers whose populations are at the highest risk for flooding from coastal storms
- Demonstrates the value of a linked information framework to provide water quantity and quality information
- Reduced loss of life and property from weather and water hazards in the Carolinas and across our nation